CLAIMS

WHAT IS CLAIMED IS:

1. A method for determining an individual's risk for obesity, the method comprising: detecting presence of at least one obesity-related polymorphism in a frizzled-related protein (FRZB) gene in a nucleic acid sample of the individual, wherein the presence of said at least one polymorphism provides an indication of the individual's risk for obesity.

2. The method of claim 1, wherein the individual's risk for obesity is an increased risk as compared to an individual without the at least one polymorphism.

3. The method of claim 1, wherein the individual's risk for obesity is a decreased risk as compared to an individual without the at least one polymorphism.

4. The method of claim 1, wherein the at least one polymorphism comprises a predisposing or protective polymorphism in the FRZB gene.

5. The method of claim 1, wherein the nucleic acid sample comprises DNA or RNA.

6. The method of claim 1, wherein the at least one polymorphism comprises at least one single nucleotide polymorphism (SNP).

7. The method of claim 6, wherein the at least one polymorphism is selected from the group consisting of: T allele of T2303723C, C allele of T2303723C, C allele of C18679T, T allele of C18679T, G allele of G19524A, A allele of G19524A, T allele of T22242A, A allele of T22242A, A allele of A24791G, and G allele of A24791G.

8. The method of claim 1, wherein the at least one polymorphism comprises two or more polymorphisms.

9. The method of claim 8, wherein at least one of the two or more polymorphisms is selected from the group consisting of: T allele of T2303723C, C allele of T2303723C, C allele of C18679T, T allele of C18679T, G allele of G19524A, A

allele of G19524A, T allele of T22242A, A allele of T22242A, A allele of A24791G, and G allele of A24791G.

10. The method of claim 8, wherein the two or more polymorphisms are selected from the group consisting of: T allele of T2303723C, C allele of T2303723C, C allele of C18679T, T allele of C18679T, G allele of G19524A, A allele of G19524A, T allele of T22242A, A allele of T22242A, A allele of A24791G, and G allele of A24791G.

11. The method of claim 1, wherein the at least one polymorphism is detected by sequencing.

12. The method of claim 1, wherein the at least one polymorphism is detected by amplification.

13. The method of claim 12, wherein the amplification comprises a polymerase chain reaction or a ligase chain reaction.

14. The method of claim 1, wherein the detecting comprises:

- contacting the nucleic acid sample with at least one sequence-specific oligonucleotide under conditions that allow binding of said at least one oligonucleotide to the nucleic acid sample, wherein the at least one sequence-specific oligonucleotide hybridizes under stringent conditions to a region of the FRZB gene comprising the at least one obesity-related polymorphism; and,

- detecting the hybridization of the at least one oligonucleotide to the nucleic acid sample.

15. The method of claim 1, wherein the detecting comprises:

- amplifying the nucleic acid sample, thereby providing an amplified nucleic acid sample;

- contacting the amplified nucleic acid sample with at least one sequence-specific oligonucleotide under conditions that allow binding of the oligonucleotide to the amplified nucleic acid sample,

wherein the at least one sequence-specific oligonucleotide hybridizes under stringent conditions to a region of the FRZB gene comprising the at least one obesity-related polymorphism; and,

- detecting the hybridization of the at least one sequence-specific oligonucleotide to the amplified nucleic acid sample.

16. The method of claim 1, wherein detecting the presence of the at least one obesity-related polymorphism comprises qualitatively detecting the presence of the at least one obesity-related polymorphism.

17. The method of claim 1, wherein detecting the presence of the at least one obesity-related polymorphism comprises quantitatively detecting the presence of the at least one obesity-related polymorphism.

18. The method of claim 1, wherein the presence of the polymorphism inherited from one of the individual's parents provides an indication of the individual's risk for obesity, or wherein the presence of the polymorphism inherited from both of the individual's parents provides an indication of the individual's risk for obesity.

19. The method of claim 1, comprising performing at least one clinical test for obesity.

20. The method of claim 19, wherein performing the at least one clinical test for obesity comprises determining a body mass index (BMI) of the individual.

21. A method for determining an individual's risk for osteoporosis, the method comprising: detecting presence of at least one osteoporosis-related polymorphism in an FRZB gene in a nucleic acid sample of the individual, wherein the presence of said at least one polymorphism provides an indication of the individual's risk for osteoporosis.

22. The method of claim 21, wherein the individual's risk for osteoporosis is an increased risk as compared to an individual without the at least one polymorphism.

23. The method of claim 21, wherein the individual's risk for osteoporosis is a decreased risk as compared to an individual without the at least one polymorphism.

24. The method of claim 21, wherein the at least one polymorphism comprises a predisposing or protective polymorphism in the FRZB gene.

25. The method of claim 21, wherein the nucleic acid sample comprises DNA or RNA.

26. The method of claim 21, wherein the at least one polymorphism comprises at least one single nucleotide polymorphism (SNP).

27. The method of claim 26, wherein the at least one polymorphism is selected from the group consisting of: C allele of C18679T, T allele of C18679T, G allele of G19524A, A allele of G19524A, A allele of A24791G, G allele of A24791G, C allele of C26794G, G allele of C26794G, G allele of G27014A, and A allele of G27014A.

28. The method of claim 21, wherein the at least one polymorphism comprises two or more polymorphisms.

29. The method of claim 28, wherein at least one of the two or more polymorphisms is selected from the group consisting of: C allele of C18679T, T allele of C18679T, G allele of G19524A, A allele of G19524A, A allele of A24791G, G allele of A24791G, C allele of C26794G, G allele of C26794G, G allele of G27014A, and A allele of G27014A.

30. The method of claim 28, wherein the two or more polymorphisms are selected from the group consisting of: C allele of C18679T, T allele of C18679T, G allele of G19524A, A allele of G19524A, A allele of A24791G, G allele of A24791G, C allele of C26794G, G allele of C26794G, G allele of G27014A, and A allele of G27014A.

31. The method of claim 21, wherein the at least one polymorphism is detected by sequencing.

32. The method of claim 21, wherein the at least one polymorphism is detected by amplification.

33. The method of claim 32, wherein the amplification comprises a polymerase chain reaction or a ligase chain reaction.

34. The method of claim 21, wherein the detecting comprises:

- contacting the nucleic acid sample with at least one sequence-specific oligonucleotide under conditions that allow binding of the oligonucleotide to the nucleic acid sample, wherein the at least one sequence-specific oligonucleotide hybridizes under stringent conditions to a region of the FRZB gene comprising the at least one osteoporosis-related polymorphism; and,

- detecting the hybridization of the at least one sequence-specific oligonucleotide to the nucleic acid sample.

35. The method of claim 21, wherein the detecting comprises:

- amplifying the nucleic acid sample, thereby providing an amplified nucleic acid sample;

- contacting the amplified nucleic acid sample with at least one sequence-specific oligonucleotide under conditions that allow binding of the oligonucleotide to the amplified nucleic acid sample, wherein the at least one sequence-specific oligonucleotide hybridizes under stringent conditions to a region of the FRZB gene comprising the at least one osteoporosis-related polymorphism; and,

- detecting the hybridization of the at least one sequence-specific oligonucleotide to the amplified nucleic acid sample.

36. The method of claim 21, wherein detecting the presence of the at least one osteoporosis-related polymorphism comprises qualitatively detecting the presence of the at least one osteoporosis-related polymorphism.

37. The method of claim 21, wherein detecting the presence of the at least one osteoporosis-related polymorphism comprises quantitatively detecting the presence of the at least one osteoporosis-related polymorphism.

38. The method of claim 21, wherein the presence of the polymorphism inherited from one of the individual's parents provides an indication of the individual's risk for osteoporosis, or wherein the presence of the polymorphism inherited from both of the individual's parents provides an indication of the individual's risk for osteoporosis.

39. The method of claim 21, comprising performing at least one clinical test for osteoporosis.

40. The method of claim 39, wherein the at least one clinical test for osteoporosis comprises a bone-turnover assay or a bone scan.

41. A method for determining an individual's risk for obesity and/or osteoporosis, the method comprising: determining the individual's genotype at one or more polymorphic sites in an FRZB gene, wherein a first genotype at the one or more polymorphic sites is statistically associated with an increased risk for obesity and/or osteoporosis as compared to a second genotype at the one or more polymorphic sites.

42. The method of claim 41, wherein at least one of the one or more polymorphic sites consists of a single nucleotide position.

43. The method of claim 42, wherein the individual's genotype is determined at a plurality of polymorphic sites in the FRZB gene, and wherein each of the polymorphic sites consists of a single nucleotide position.

44. The method of claim 41, wherein at least one of the one or more polymorphic sites is selected from the group consisting of: nucleotide position 2628, nucleotide position 18679, nucleotide position 19524, nucleotide position 22242, nucleotide position 24791, nucleotide position 26794, and nucleotide position 27014 of SEQ ID NO:1.

45. The method of claim 41, wherein the first genotype is statistically associated with an increased risk for obesity as compared to the second genotype; and wherein the first genotype comprises two T alleles and the second genotype two C alleles or one T allele and one C allele of SNP T2303723C, the first genotype comprises two T alleles and the second genotype two C alleles or one T allele and one C allele of SNP C18679T, the first genotype comprises two A alleles and the second genotype two G alleles or one A allele and one G allele of SNP G19524A, the first genotype comprises two A alleles and the second genotype two T alleles or one A allele and one T allele of SNP T22242A, and/or the first genotype comprises two G alleles and the second genotype two A alleles or one G allele and one A allele of SNP A24791G.

46. The method of claim 41, wherein the first genotype is statistically associated with an increased risk for osteoporosis as compared to the second genotype; and wherein the first genotype comprises two C alleles and the second genotype two T alleles or one T allele and one C allele of SNP C18679T, the first genotype comprises two G alleles and the second genotype two A alleles or one A allele and one G allele of SNP G19524A, the first genotype comprises two A alleles and the second genotype two G alleles or one G allele and one A allele of SNP A24791G, the first genotype comprises two C alleles and the second genotype two G alleles or one C allele and one G allele of SNP C26794G, and/or the first genotype comprises two G alleles and the second genotype two A alleles or one G allele and one A allele of SNP G27014A.

47. The method of claim 41, wherein determining the individual's genotype comprises obtaining a nucleic acid sample from the individual.

48. The method of claim 47, wherein determining the individual's genotype comprises amplifying at least a portion of the FRZB gene from the nucleic acid sample, the portion comprising at least one of the one or more polymorphic sites.

49. The method of claim 47, wherein determining the individual's genotype comprises performing an allele-specific amplification or an allele-specific extension reaction.

50. The method of claim 47, wherein determining the individual's genotype comprises sequencing at least a portion of the FRZB gene from the nucleic acid sample, the portion comprising at least one of the one or more polymorphic sites.

51. The method of claim 47, wherein at least one of the one or more polymorphic sites consists of a single nucleotide position, the method comprising:

- contacting the nucleic acid sample with at least one sequence-specific oligonucleotide under stringent conditions, wherein the oligonucleotide hybridizes under the stringent conditions to the nucleic acid sample when a first nucleotide occupies the nucleotide position defining the polymorphic site but not when a second nucleotide occupies the nucleotide position, and
- detecting hybridization of the oligonucleotide to the nucleic acid sample.

52. A kit for detecting presence of a first predisposing or protective polymorphism in an FRZB gene in a nucleic acid sample of an individual whose risk for osteoporosis and/or obesity is being assessed, the kit comprising: one or more first oligonucleotides capable of detecting the first polymorphism, and instructions for detecting the first polymorphism with the one or more first oligonucleotides and for correlating said detection to the individual's risk for osteoporosis and/or obesity, packaged in one or more containers.

53. The kit of claim 52, wherein the first polymorphism is a single nucleotide polymorphism.

54. The kit of claim 53, wherein the first polymorphism is selected from the group consisting of: T allele of T2303723C, C allele of T2303723C, C allele of C18679T, T allele of C18679T, G allele of G19524A, A allele of G19524A, T allele of T22242A, A allele of T22242A, A allele of A24791G, G allele of A24791G, C allele of C26794G, G allele of C26794G, G allele of G27014A, and A allele of G27014A.

55. The kit of claim 52, wherein the one or more first oligonucleotides comprise at least one probe.

56. The kit of claim 52, wherein the first oligonucleotide hybridizes under stringent conditions to a region of the FRZB gene comprising the first polymorphism.

57. The kit of claim 56, wherein the first polymorphism is a first single nucleotide polymorphism comprising a first nucleotide at a first nucleotide position, and wherein, under stringent conditions, the first oligonucleotide hybridizes to a region of the FRZB gene comprising the first single nucleotide polymorphism with a signal to noise ratio that is at least 2x that at which the first oligonucleotide hybridizes to the region of the FRZB gene comprising a second nucleotide at the first nucleotide position.

58. The kit of claim 56, wherein the first oligonucleotide is fully complementary to the region of the FRZB gene comprising the first polymorphism.

59. The kit of claim 56, wherein the first oligonucleotide comprises at least about 10 contiguous nucleotides complementary to the FRZB gene.

60. The kit of claim 52, wherein the one or more first oligonucleotides comprise a label.

61. The kit of claim 60, wherein the label comprises an isotopic, fluorescent, fluorogenic or colorimetric label.

62. The kit of claim 60, comprising a reagent, wherein the reagent detects the label.

63. The kit of claim 52, wherein the one or more first oligonucleotides comprise one or more primers.

64. The kit of claim 63, wherein the first polymorphism is a first single nucleotide polymorphism comprising a first nucleotide at a first nucleotide position, and wherein the 3' nucleotide of one of the one or more first oligonucleotides is complementary to the first nucleotide.

65. The kit of claim 52, wherein the one or more first oligonucleotides comprise amplification primers, wherein the amplification primers amplify a nucleic acid sequence comprising the first polymorphism.

66. The kit of claim 52, wherein the one or more first oligonucleotides comprise sequencing primers, wherein the sequencing primers flank the first polymorphism.

67. The kit of claim 52, wherein the one or more first oligonucleotides are immobilized on a substrate.

68. The kit of claim 52, comprising one or more second oligonucleotides capable of detecting a second polymorphism.

69. An array for detecting presence of one or more predisposing and/or protective polymorphisms in an FRZB gene in a nucleic acid sample of an individual whose risk for osteoporosis and/or obesity is being assessed, the array comprising:

- a plurality of oligonucleotides, each of which oligonucleotides hybridizes to a region of the FRZB gene comprising at least one of the polymorphisms, whereby said hybridization detects the presence of the polymorphism, whereby said detection provides an indication of the individual's risk for osteoporosis and/or obesity; and,
- a substrate on which the plurality of oligonucleotides are immobilized.

70. The array of claim 69, wherein the one or more polymorphisms comprise one or more single nucleotide polymorphisms.

71. The array of claim 70, wherein at least one of the one or more polymorphisms is selected from the group consisting of: T allele of T2303723C, C allele of T2303723C, C allele of C18679T, T allele of C18679T, G allele of G19524A, A allele of G19524A, T allele of T22242A, A allele of T22242A, A allele of A24791G, G allele of A24791G, C allele of C26794G, G allele of C26794G, G allele of G27014A, and A allele of G27014A.

72. The array of claim 70, wherein, under stringent conditions, each of the oligonucleotides hybridizes to a region of the FRZB gene comprising one of the single nucleotide polymorphisms with a signal to noise ratio that is at least 2x

that at which the oligonucleotide hybridizes to a region of the FRZB gene comprising any of the remaining single nucleotide polymorphisms.

73. The array of claim 70, wherein each of the oligonucleotides hybridizes to a distinct single nucleotide polymorphism.

74. The array of claim 69, wherein each of the plurality of oligonucleotides is immobilized at a known, pre-determined position on the substrate.

75. The array of claim 69, wherein each of the plurality of oligonucleotides is fully complementary to a region of the FRZB gene comprising one of the polymorphisms.

76. The array of claim 69, wherein each of the plurality of oligonucleotides comprises at least about 10 contiguous nucleotides complementary to the FRZB gene.

77. The array of claim 69, wherein each of the plurality of oligonucleotides comprises a label.

78. A system, comprising: the array of claim 69 and system instructions that correlate said detection of the presence of one or more predisposing or protective polymorphisms to the individual's risk for osteoporosis and/or obesity.